

## **VARIABLE VALVE LIFT MECHANISM FOR AN ENGINE**

### **CROSS-REFERENCE TO RELATED APPLICATIONS**

**[0001]** This application claims priority to Korean Patent Application No. 10-2003-0069567, filed on October 7, 2003, which is incorporated fully herein by reference.

### **FIELD OF THE INVENTION**

**[0002]** The present invention relates to a variable valve lift mechanism for an engine and, more particularly, to a technique adapted to vary a rocker arm condition in an engine containing a rocker arm at a valve train to adjust the valve lift.

### **BACKGROUND OF THE INVENTION**

**[0003]** Generally, an adequate valve lift varies according to an operating condition of an engine such that it is necessary to vary a valve lift according to the operating condition in order for the engine to achieve optimal performance for an entire operating region.

### **SUMMARY OF THE INVENTION**

**[0004]** The present invention provides a simple structure for creating an enabling mechanism to vary a rocker arm's movement in the engine when applying a valve train that uses a rocker arm, whereby the valve lift can be adequately varied in response to an operating condition of the engine.

**[0005]** In accordance with a preferred embodiment of the present invention, the variable valve lift mechanism for an engine comprises a rocker arm for transmitting the cam movement to a stem end of a valve. A rotating axle movement means moves a

rotating axle of the rocker arm on a moving plane, which is a plane perpendicular to the rotating axle of the rocker arm. A restricting means restricts the rocker arm to prohibit the rocker arm from moving along a longitudinal direction of the rocker arm.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

**[0006]** For a better understanding of the nature and objects of the present invention, reference should be made to the following detailed description with the accompanying drawings, in which:

**[0007]** FIG. 1 is a structural drawing of a variable valve lift mechanism for an engine according to an embodiment of the present invention;

**[0008]** FIG. 2 is a perspective view for illustrating a connecting relationship of the essential parts of FIG. 1; and

**[0009]** FIG. 3 is a schematic drawing for explaining the operation of a cam plate and a hitching pin.

### **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT**

**[0010]** The preferred embodiment of the present invention will now be described in detail with reference to the annexed drawings, where the present embodiment is not limiting the scope of the present invention but is given only as an illustrative purpose.

**[0011]** Referring to FIG. 1, the variable valve lift mechanism for an engine according to an embodiment of the present invention comprises: a rocker arm 7 for transmitting movement of a cam 1 to a stem end 5 of a valve 3; rotating axle movement means for moving a rotating axle of the rocker arm 7 on a moving plane (X) that is a plane perpendicular to the rotating axle of the rocker arm 7; and restricting means for

restricting the rocker arm 7 to prohibit the rocker arm 7 from moving along a longitudinal direction of the rocker arm 7.

[0012] The rotating axle movement means in the present embodiment includes a sliding arm 9 supported by the rocker arm 7 so as to linearly slide along a longitudinal direction of the rocker arm 7 on the moving plane, a moveable shaft 11 rotatably supported by the sliding arm 9 to function as a rotating axle of the rocker arm 7, and a sliding means for linearly sliding the moveable shaft 11 along a longitudinal direction of the rocker arm 7.

[0013] Both ends of the sliding arm 9 penetrates and are supported by a cam side protruder 13 integrally formed at the rocker arm 7 toward a cam 1 and a valve side protruder 15 integrally formed at the rocker arm 7 toward the valve 3.

[0014] The restricting means includes a roller 17 rotatably secured at the cam side protruder 13 to contact the cam 1 and a roller guide 19 to guide the roller 17 to linearly move to a direction perpendicular to a longitudinal direction of the rocker arm 7. The roller guide 19 has a plurality of guide rollers 21 to reduce the friction created when the roller 17 is contacted by the guide rollers 21.

[0015] Referring to FIGS. 2 and 3, the sliding means includes a hitching pin 23 protruding along an axial direction of the moveable shaft 11, a cam plate 27 with an oval hole 25 for the hitching pin 23 to linearly slide therein, a motor 29 for rotating the cam plate 27 so that the hitching pin 23 inserted into the oval hole 25 can linearly move along a longitudinal direction of the rocker arm 7, and a controller for controlling the motor 29 in response to an operating condition of an engine.

[0016] Referring again to FIG. 3, the motor 29 is eccentrically formed at a rotating axle thereof relative to the hitching pin 23 on a longitudinal extension line of the oval hole 25, such that, when the cam plate 27 is horizontally rotated, the hitching

pin 23 slides into the oval hole 25 to horizontally and linearly move as shown by the dotted line in FIG. 3.

**[0017]** The controller is preferably an engine electronic control unit (ECU 31) for controlling the operating condition of the engine. The moveable shaft 11 is disposed with a guide shaft 33, the guide shaft 33 being parallel with the sliding arm 9 for guiding the movement of the moveable shaft 11 and passing through the moveable shaft 11 as shown in FIG. 2. The guide shaft 33 is of course secured to a cylinder head.

**[0018]** Next, the operation of the present invention thus constructed will be described.

**[0019]** The moveable shaft 11 is positioned leaning toward the left in FIG.1 when the engine is running at a slow speed.

**[0020]** The distance or a length covered by the rocker arm 7 when lifted by the rotating cam 1 is varied according to a ratio, which is then transmitted to the valve 3, where the ratio is calculated based on a linear distance from a contact point between the cam 1 and the rocker arm 7 to the moveable shaft 11 and a linear distance from a contact point between the stem end 5 of the valve and the rocker arm 7 to the moveable shaft 11.

**[0021]** When the moveable shaft 11 is leaning toward the valve 3 side as mentioned above, the ratio becomes smaller to make the valve lift relatively short.

**[0022]** Under the state thus described above, the more the moveable shaft 11 is moved to the right (*i.e.*, toward the roller), the larger the ratio becomes, and the valve lift grows gradually larger, even though the distance of the rocker arm 7 lifted by the cam 1 is constant. As a result, the engine ECU 31 can simply embody a valve lift by way of the rotation of the motor 29 in response to the running state of the engine.

**[0023]** In other words, when the engine ECU 31 drives the motor 29, the cam plate 27 is rotated to move the hitching pin 23 as depicted in FIG. 3. When the hitching pin 23 is moved, the moveable shaft 11 is supported by the guide shaft 33 to move along the longitudinal direction of the rocker arm 7. As a result, the rotating axle of the rocker arm 7 moves between the cam 1 and the valve 3 to adjust the distance of the rocker arm 7 lifted by the cam 1 at an appropriate ratio, which is then supplied to the valve 3 to prompt the valve lift to be varied.

**[0024]** As apparent from the foregoing, there is an advantage in the variable valve lift mechanism for an engine thus described according to an embodiment of the present invention in that a valve lift can be varied in real time, and in a simple construction, in response to an operating state of the engine, thereby enabling maximum engine efficiency and improving the output and fuel consumption rate of the engine.

**[0025]** The foregoing description of the preferred embodiment of the present invention has been presented for the purpose of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed, and modifications and variations are possible in light of the above teachings or may be acquired from practice of the invention. It is intended that the scope of the invention be defined by the claims appended hereto and their equivalents.